



## Digital supplementary material to

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Myrmecophilous organisms associated with colonies of the ponerine ant *Neoponera villosa* (Hymenoptera: Formicidae) nesting in *Aechmea bracteata* bromeliads: a biodiversity hotspot.

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Appendix, as digital supplementary material to this article, at the journal's web pages:

**Tab. S1:** *Neoponera villosa* colonies composition.

**Tab. S2:** Organisms reported in the literature as associated with ants of the genus *Neoponera* EMERY, 1901, and type of interaction.

**Fig. S1:** Relationship between available host brood and selected myrmecophiles. (A) Relationship between the number of parasitized cocoons and the number of available cocoons in colonies parasitized by the ectoparasitoids *Kapala* sp. (Hymenoptera: Eucharitidae) and *Hypselosyrphus trigonus* (Diptera: Syrphidae). (B, C) Relationship between the number of pseudoscorpions and the target brood stages: (B) ant larvae, (C) ant cocoons.

**Fig. S2:** *Neoponera villosa* myrmecophiles exploring the host cocoons. (A) *Trichopria* sp. (B) *Myrmigaster* sp.

**Video S1:** Exploring behavior of *Myrmigaster* sp. on *Neoponera villosa* cocoons.

Tab. S1: *Neoponera villosa* colonies composition

Colony number	Queens	Gynes	Males	Workers	Larvae	Cocoons
1	16	1	0	322	5	65
2	13	4	0	226	8	13
3	4	0	0	75	28	20
4	8	10	22	185	161	261
5	5	3	0	107	63	51
6	10	0	0	122	32	22
7	0	0	6	5	1	5
8	17	4	0	206	45	29
9	1	0	0	186	51	97
10	20	21	0	73	49	44
11	6	0	0	84	3	3
12	1	0	0	115	101	40
13	1	0	0	143	44	74
14	1	0	0	180	69	65
15	7	1	0	145	72	9
16	10	0	0	283	22	8
17	8	0	0	285	72	19
18	2	0	0	74	1	4
19	1	0	0	27	15	4
20	7	0	0	117	4	3
21	1	0	0	47	39	27
22	11	3	0	165	265	173
23	4	0	0	33	19	25
24	0	0	0	10	2	4
25	1	0	0	113	43	94
26	0	0	0	40	58	41
27	5	1	0	131	70	150
28	2	0	0	65	39	79
29	1	0	0	104	42	86
30	7	4	0	150	38	62
31	4	0	0	196	132	173
32	0	0	0	3	0	2
33	0	0	26	60	0	2
34	2	0	0	160	78	103
35	0	0	0	57	9	19
36	6	0	0	40	17	13
37	3	0	0	62	17	25
38	2	0	0	142	43	91
39	1	0	0	21	9	14

40	0	0	0	7	6	3
41	1	0	0	82	14	20
42	1	0	0	44	16	21
43	1	0	0	84	46	40
44	11	0	0	46	58	35
45	0	0	0	43	15	19
46	3	0	0	82	55	32
47	5	1	0	107	74	30
48	2	1	0	43	8	7
49	1	0	0	21	15	6
50	1	0	0	12	9	2
51	10	0	0	280	21	78
52	3	0	0	82	34	32
53	1	0	0	29	43	15
54	0	0	0	43	44	16
55	3	0	0	17	8	4
56	1	0	0	40	26	39
57	1	0	0	133	37	52
58	1	0	0	83	14	25
59	2	0	0	18	18	8
60	1	0	0	32	10	3
61	0	0	0	51	12	3
62	1	3	0	62	7	25
63	2	2	0	70	16	64
64	1	0	0	116	40	77
65	6	2	0	223	163	69
66	1	6	29	53	38	28
67	1	0	0	207	34	80
68	1	0	0	91	42	83
69	1	8	12	48	22	49
70	1	6	4	126	40	35
71	1	1	39	74	21	23
72	1	2	0	87	37	47
73	1	0	0	43	29	24
74	2	5	2	77	88	24
75	1	1	0	45	4	15
76	1	0	0	50	37	28
77	4	2	1	119	58	55
78	1	2	3	99	56	38
79	1	0	0	171	93	61
80	2	0	0	197	149	31
81	6	4	0	52	15	20
82	1	0	0	74	30	78

Tab. S2: Organisms reported in the literature as associated with ants of the genus *Neoponera* EMERY, 1901, and type of interaction.

Class	Order	Family	Taxon	Host	Interaction with ants	Country	Reference
Nematoda	Mermithida	Mermithidae	Unidentified	<i>N. inversa</i> <i>N. villosa</i>	Parasite of workers	Colombia, Venezuela	EMERY 1904; WHEELER 1928;
Arachnida	Sarcoptiformes	Histiostomatidae	<i>Histiostoma</i> spp.	<i>N. apicalis</i> <i>N. inversa</i> <i>N. verenae</i> <i>N. villosa</i>	Hypopus <sup>1</sup> phoretic on workers (mandibles)	Brazil	LOPES & al. 2015a
	Mesostigmata	Laelapidae	<i>Cosmolaelaps</i> spp.	<i>N. apicalis</i> <i>N. verenae</i> <i>N. villosa</i>	Phoretic? Adults and immatures found upon cocoons	Brazil	LOPES & al. 2015a
			<i>Cosmolaelaps pronex</i> SILVA, MOREIRA & OLIVEIRA, 2018	<i>N. inversa</i>	Females and males phoretic on ant brood (mostly cocoons)	Brazil	SILVA & al. 2018
		Oplitidae	<i>Oplitis</i> spp.	<i>N. apicalis</i> <i>N. inversa</i> <i>N. verenae</i> <i>N. villosa</i>	Females phoretic on workers (legs)	Brazil	LOPES & al. 2015a
			<i>Oplitis apicalis</i> LOPES, OLIVEIRA DELABIE & KLÖMPEN, 2015	<i>N. apicalis</i> <i>N. inversa</i> <i>N. verenae</i>	Females phoretic on workers (legs)	Brazil	LOPES & al. 2015b
	Trombidiformes	Neopygmephoridae	<i>Petalomium</i> spp.	<i>N. apicalis</i> <i>N. inversa</i> <i>N. verenae</i> <i>N. villosa</i>	Females phoretic on workers (between the coxae)	Brazil	LOPES & al. 2015a

			<i>Petalomium verenae</i> SILVA, KHAUSTOV & OLIVEIRA, 2017	<i>N. verenae</i>	Females phoretic on workers (thorax, ventrad)	Brazil	SILVA & al. 2017
Entognatha	Collembola	Cyphoderidae	<i>Cyphoderus similis</i> FOLSOM, 1927 <i>Folsomides parvulus</i> STACH, 1922	<i>N. inversa</i> <i>N. villosa</i>	Ant associates	Brazil	CASTAÑO-MENESES & al. 2015
		Isotomidae	<i>Proisotoma minima</i> (ABSOLON, 1901)				
		Brachystomellidae	<i>Brachystomella</i> sp.				
		Neanuridae	<i>Arlesia albipes</i> (FOLSOM, 1927)				
		Entomobryidae	<i>Pseudosinella</i> sp.	<i>N. inversa</i>	Ant associates	Brazil	CASTAÑO-MENESES & AL. 2015
		Sminthurididae	<i>Sphaeridia serrata</i> FOLSOM & MILLS, 1938				
		Neelidae	<i>Megalothorax</i> sp.				
Insecta	Hymenoptera	Encyrtidae	<i>Blanchardiscus</i> sp. ca <i>pollux</i> NOYES, 2004	<i>N. goeldii</i>	Gregarious endoparasitoid of pupae	French Guiana	PÉREZ-LACHAUD & al. 2012
			<i>Blanchardiscus</i> sp.	<i>N. villosa</i>	Gregarious endoparasitoid of male pupae	Mexico	PÉREZ-LACHAUD & LACHAUD 2017
		Perilampidae	Unidentified	<i>N. luteola</i>	Pupal parasitoid	Peru	DAVIDSON & FISHER 1991
		Eucharitidae	<i>Kapala</i> sp.1	<i>N. apicalis</i>	Solitary, pupal ectoparasitoid	Mexico French Guiana	DE LA MORA & PHILPOTT 2010; LACHAUD & al. 2012
			<i>Kapala</i> sp.2	<i>N. verenae</i>	Solitary, pupal ectoparasitoid	French Guiana	LACHAUD & al. 2012
	Diptera	Syrphidae	<i>Hypselosyrphus trigonus</i> HULL, 1937	<i>N. villosa</i>	Solitary, pupal ectoparasitoid	Mexico	PÉREZ-LACHAUD & al. 2014

		Phoridae	<i>Apocephalus paraponerae</i> BORGMEIER, 1958 <i>A. crassilatus</i> BROWN, 2000 <i>A. globosus</i> BROWN, 2000	<i>N. villosa</i>	Females are attracted to injured ants (oviposition not confirmed) <sup>2</sup>	Brazil Colombia Costa Rica	BROWN 2000
			<i>Cataclinusa bucki</i> SCHMITZ, 1927	<i>N. crenata</i>	Males and females attracted to ant nest		BORGMEIER 1962 in DISNEY 1994
			<i>Ecitomyia juxtaposita</i> BORGMEIER, 1960	<i>N. laevigata</i>	Adult female resident in the nest		BORGMEIER 1960 in DISNEY 1994
		unidentified	unidentified	<i>N. commutata</i>	Gregarious dipteran parasitoid of ant pupae	French Guiana	LACHAUD & al. 2012

<sup>1</sup>Hypopu: deutonymph with a sucker, a morphological adaptation for attaching to host.

<sup>2</sup> Several other phorid species are attracted to injured *Neoponera* spp. See BROWN & al. 2015 (Suppl. material 1) for an exhaustive list.

### References for Table S2

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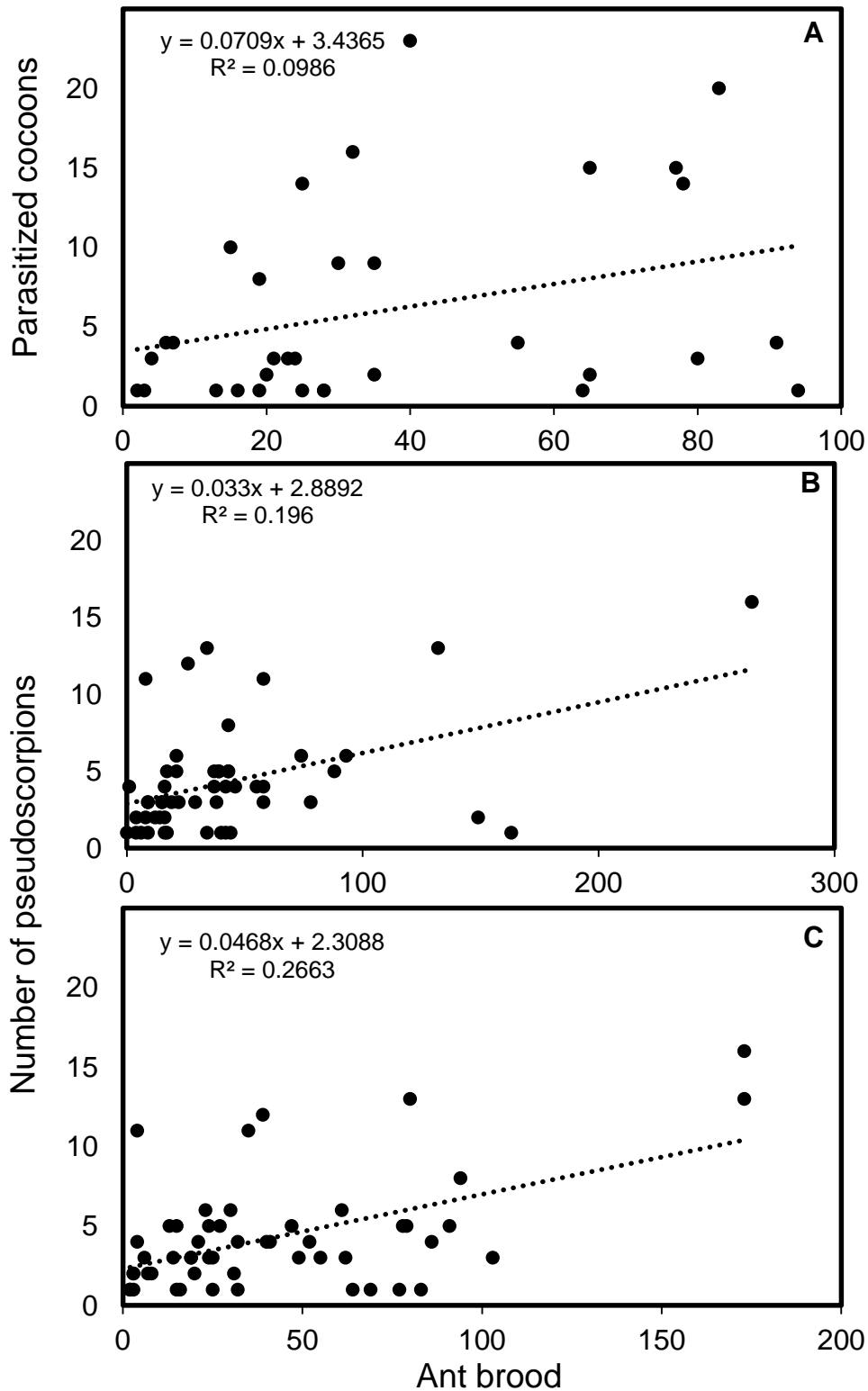
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**Fig. S1: Relationship between available host brood and selected myrmecophiles.** A) Relationship between the number of parasitized cocoons and the number of available cocoons in colonies parasitized by the ectoparasitoids *Kapala* sp. (Hymenoptera: Eucharitidae) and *Hypselosyrphus trigonus* (Diptera: Syrphidae). (B, C) Relationship between the number of pseudoscorpions and the target brood stages: (B) ant larvae, (C) ant cocoons.



**Fig. S2:** *Neoponera villosa* myrmecophiles exploring the host cocoons. (A) *Trichopria* sp. (B) *Myrmigaster* sp.